FIG.1

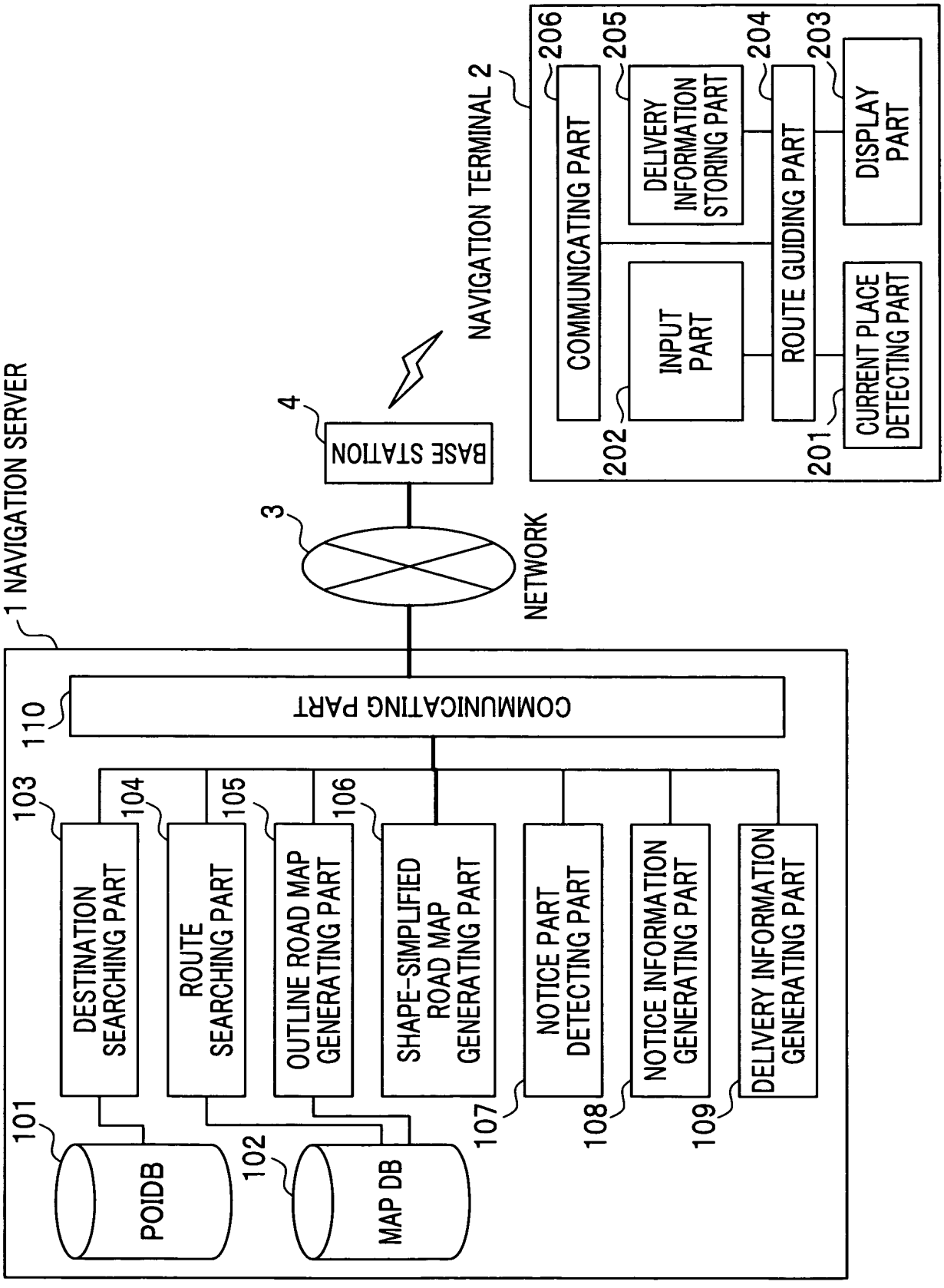

1 NAVIGATION SERVER
NAVIGATION TERMINAL 2
NETWORK
3
BASE STATION
4
COMMUNICATING PART
110
DESTINATION SEARCHING PART
103
ROUTE SEARCHING PART
104
OUTLINE ROAD MAP GENERATING PART
105
SHAPE-SIMPLIFIED ROAD MAP GENERATING PART
106
NOTICE PART DETECTING PART
107
NOTICE INFORMATION GENERATING PART
108
DELIVERY INFORMATION GENERATING PART
109
POIDB
101
MAP DB
102
COMMUNICATING PART
206
DELIVERY INFORMATION STORING PART
205
ROUTE GUIDING PART
204
DISPLAY PART
203
INPUT PART
202
CURRENT PLACE DETECTING PART
201

FIG.2

POI TABLE 1011

10112 POI ID	10113 CATEGORY ID	10114 AREA CODE	10115 COORDINATE VALUES	10116 NAME	10117 ADDRESS	10118 TELEPHONE NUMBER
0001	002	01	(x1, y1)	OOBANK	HOKKAI-DO **CITY***	********
0002	003	02	(x2, y2)	RESTAURANT x x	AOMORI-KEN **CITY**	********
0003	001	03	(x3, y3)	ΔΔDEPARTMENT STORE	AKITA-KEN **COUNTY	********
:	:	:	:	:	:	:

10111

FIG.3

CATEGORY TABLE 1012

10122 CATEGORY ID	10123 CATEGORY NAME
001	DEPARTMENT STORE
002	RESTAURANT
003	BANK
⋮	⋮

10121

FIG.4

AREA CODE TABLE 1013

10132 AREA CODE	10133 AREA NAME
001	HOKKAI-DO
002	AOMORI-KEN
003	AKITA-KEN
⋮	⋮

10131

FIG.5

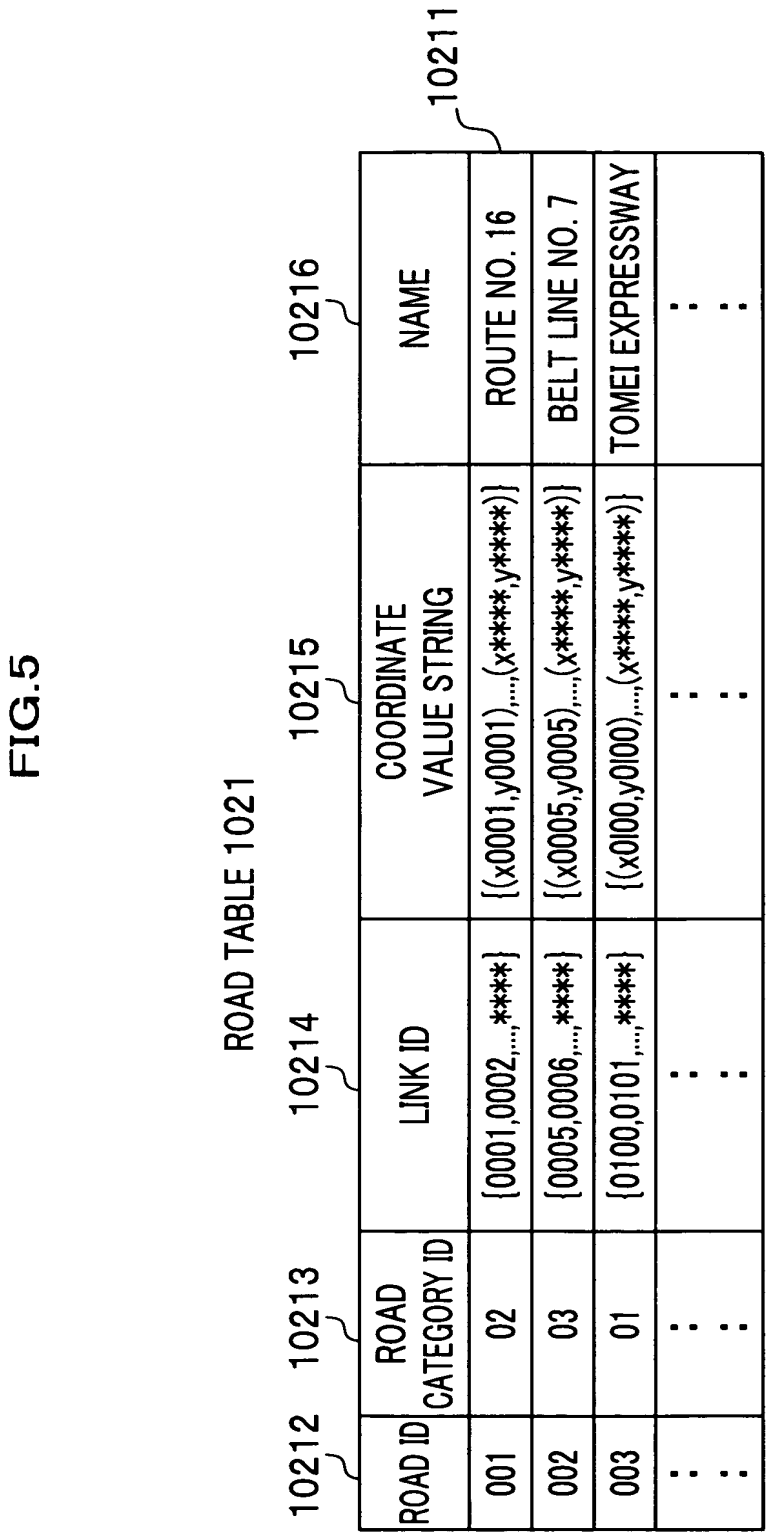

ROAD TABLE 1021
10212
10213
10214
10215
10216
10211
ROAD ID
ROAD CATEGORY ID
LINK ID
COORDINATE VALUE STRING
NAME
001
02
{0001,0002,...,****}
{(x0001,y0001),...,(x****,y****)}
ROUTE NO. 16
002
03
{0005,0006,...,****}
{(x0005,y0005),...,(x****,y****)}
BELT LINE NO. 7
003
01
{0100,0101,...,****}
{(x0100,y0100),...,(x****,y****)}
TOMEI EXPRESSWAY

FIG.6

ROAD CATEGORY TABLE 1022

10222 ROAD CATEGORY ID	10223 CATEGORY NAME
01	EXPRESSWAY
02	NATIONAL HIGHWAY
03	PREFECTURAL ROAD
⋮	⋮

10221

FIG.7

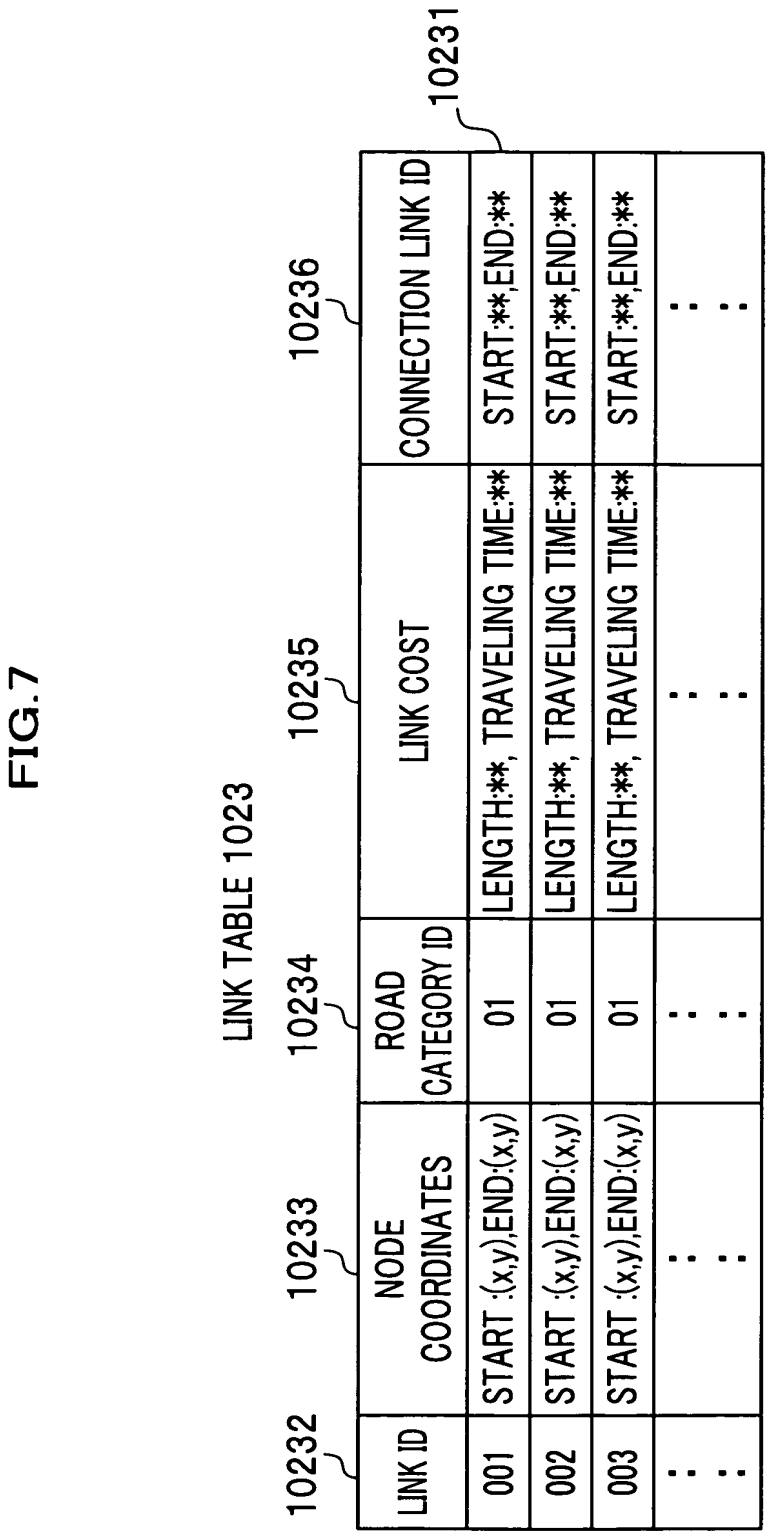

LINK TABLE 1023
10232
10233
10234
10235
10236
10231
LINK ID
NODE COORDINATES
ROAD CATEGORY ID
LINK COST
CONNECTION LINK ID
001
START :(x,y),END:(x,y)
01
LENGTH:**, TRAVELING TIME:**
START:**,END:**
002
START :(x,y),END:(x,y)
01
LENGTH:**, TRAVELING TIME:**
START:**,END:**
003
START :(x,y),END:(x,y)
01
LENGTH:**, TRAVELING TIME:**
START:**,END:**

FIG.8

BACKGROUND TABLE 1024

10242 BACKGROUND ID	10243 BACKGROUND CATEGORY ID	10244 COORDINATE VALUE STRING	10245 NAME
001	02	{(x0001,y0001),...,(x****,y****)}	CYUOSEN
002	03	{(x0005,y0005),...,(x****,y****)}	MIDORI PARK
003	01	{(x0100,y0100),...,(x****,y****)}	○○ LAKE
⋮	⋮	⋮	⋮

10241

FIG.9

BACKGROUND CATEGORY TABLE 1025

10252 BACKGROUND CATEGORY ID	10253 CATEGORY NAME
001	WATER AREA
002	RAILWAY
003	PARK
⋮	⋮

10251

FIG.10

POI-LINK RELATING TABLE 1026

10262 RELATING ID	10263 POI ID	10264 LINK ID
0001	0020	102
0002	0030	101,105
⋮	⋮	⋮

10261

FIG.11

GENERAL PROCESS

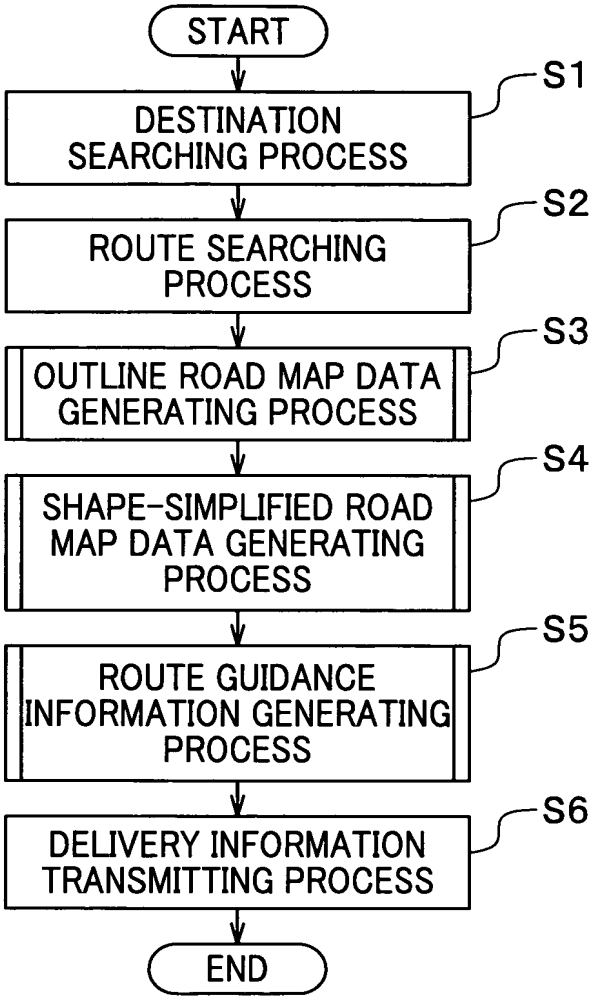


FIG.12

OUTLINE ROAD MAP DATA GENERATING PROCESS

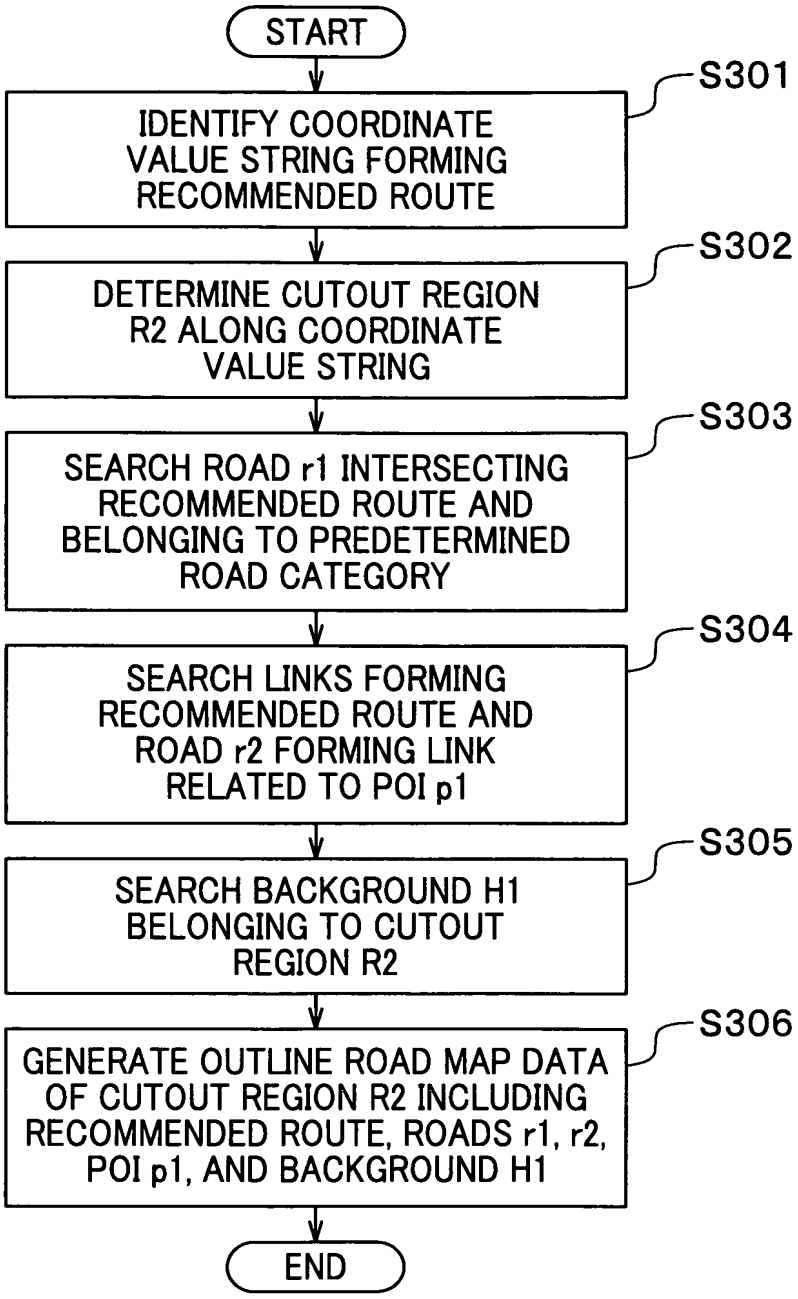


FIG.13

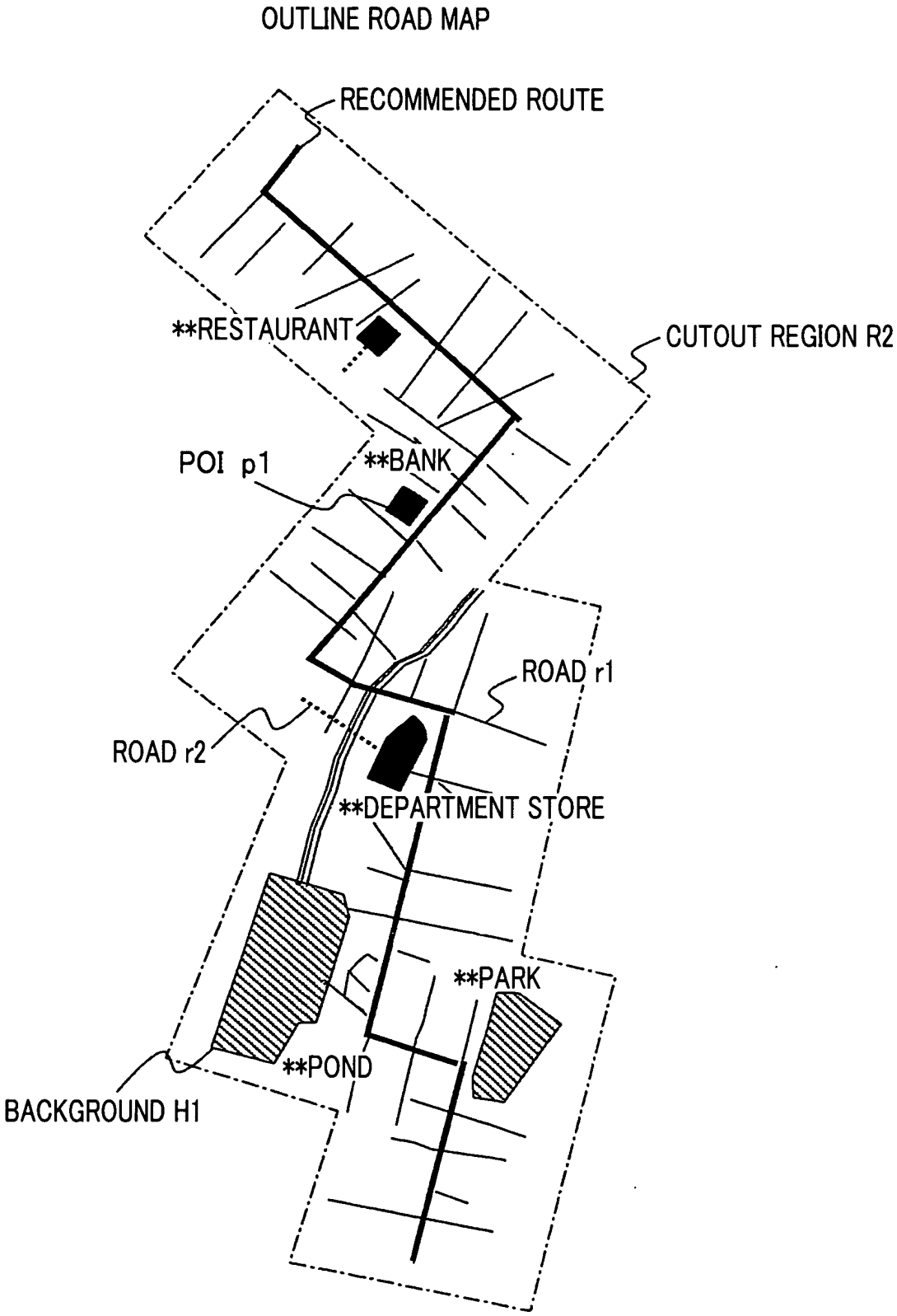

OUTLINE ROAD MAP
RECOMMENDED ROUTE
**RESTAURANT
CUTOUT REGION R2
POI p1
**BANK
ROAD r1
ROAD r2
**DEPARTMENT STORE
**PARK
**POND
BACKGROUND H1

FIG.14

SHAPE-SIMPLIFIED ROAD MAP DATA GENERATING PROCESS

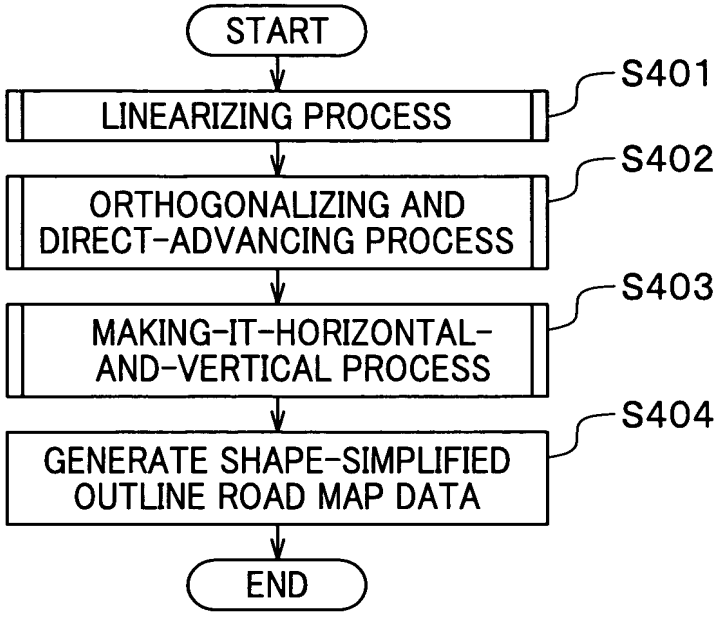


FIG.15

LINEARIZING PROCESS

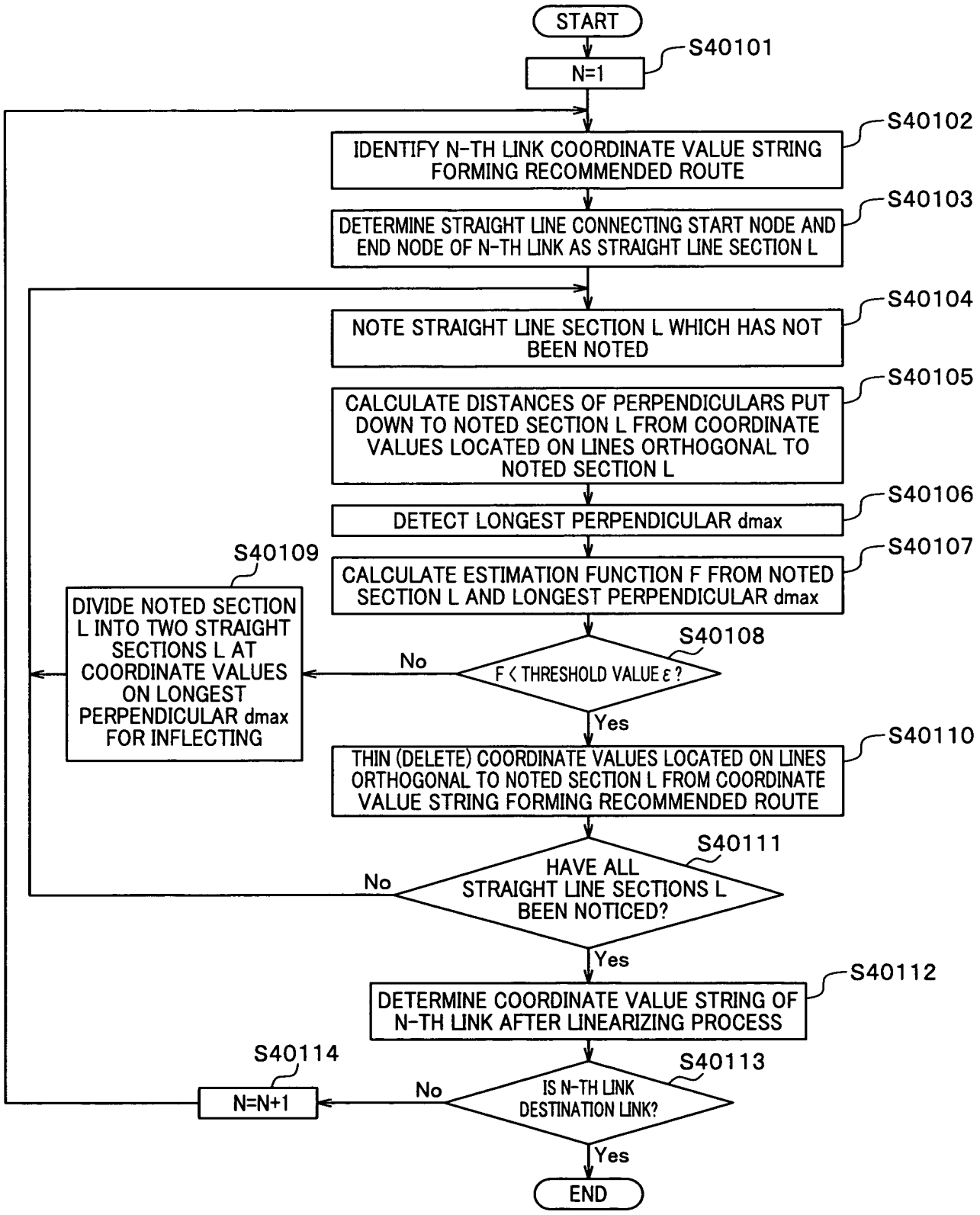


FIG.16

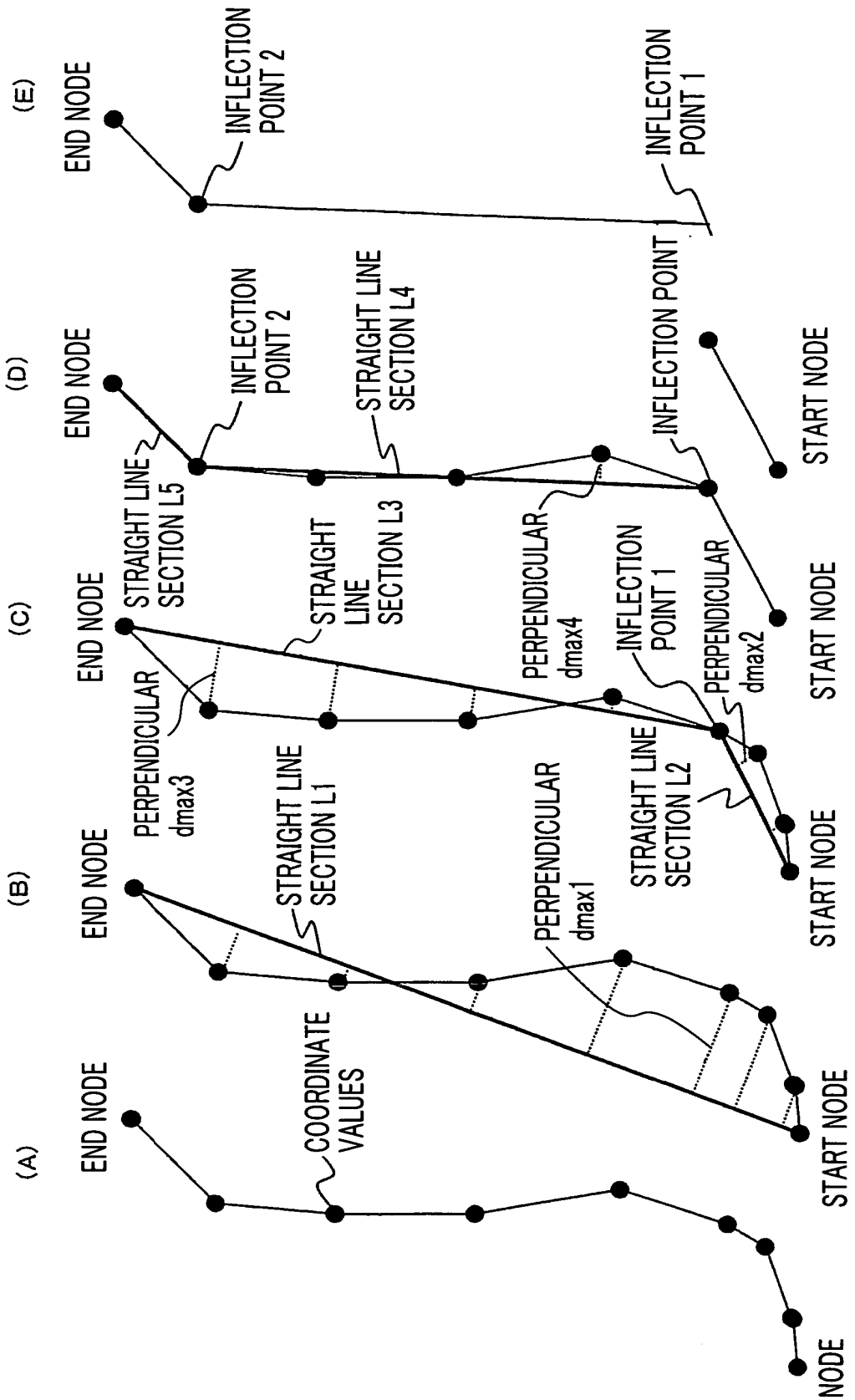

(A)
END NODE
COORDINATE VALUES
NODE
(B)
END NODE
STRAIGHT LINE SECTION L1
PERPENDICULAR dmax1
START NODE
(C)
END NODE
PERPENDICULAR dmax3
STRAIGHT LINE SECTION L5
STRAIGHT LINE SECTION L3
PERPENDICULAR dmax4
INFLECTION POINT 1
STRAIGHT LINE SECTION L2
PERPENDICULAR dmax2
START NODE
(D)
END NODE
INFLECTION POINT 2
STRAIGHT LINE SECTION L4
INFLECTION POINT
START NODE
(E)
END NODE
INFLECTION POINT 2
INFLECTION POINT 1

FIG.17

ORTHOGONALIZING AND DIRECT-ADVANCING PROCESS

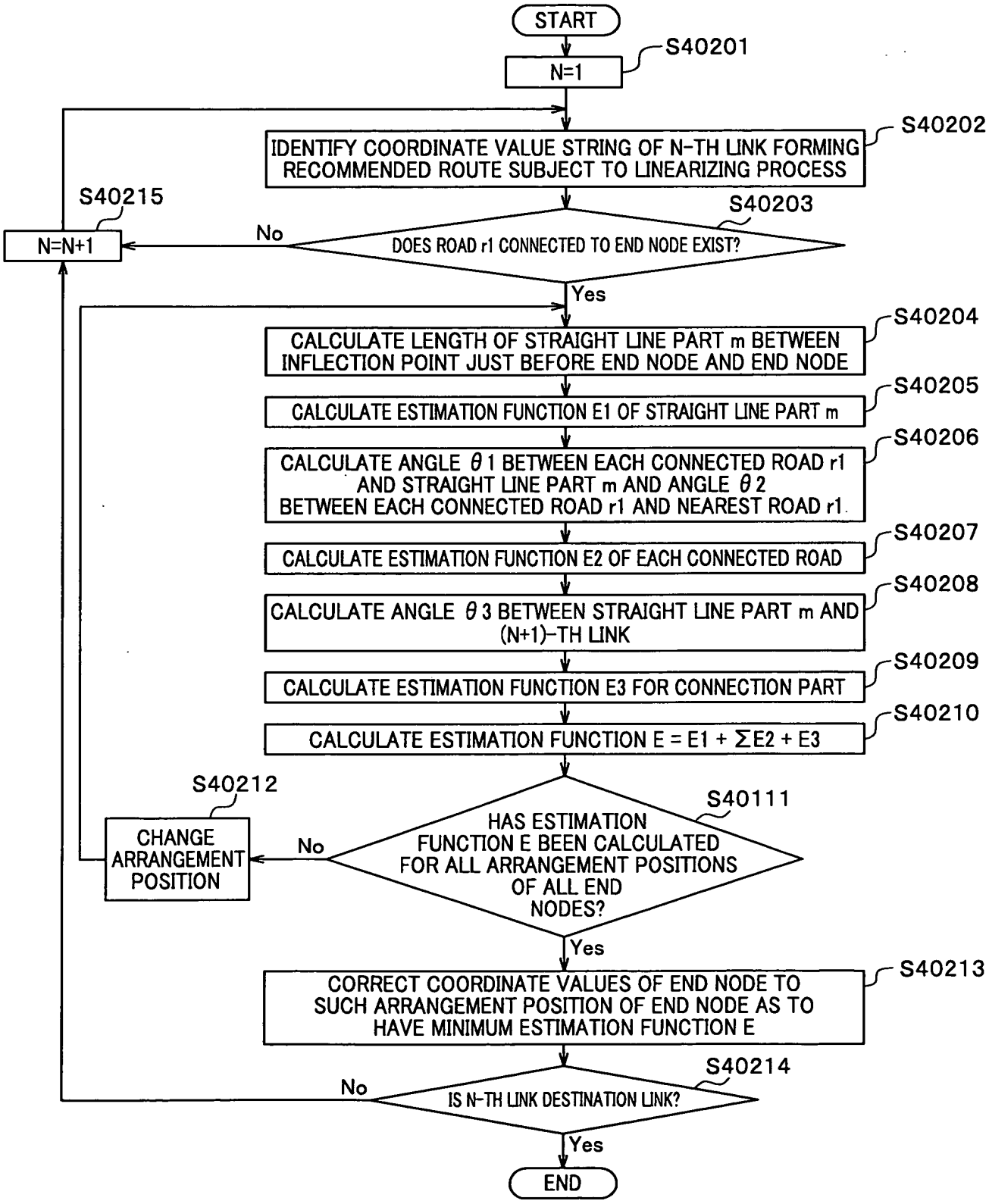


FIG.18

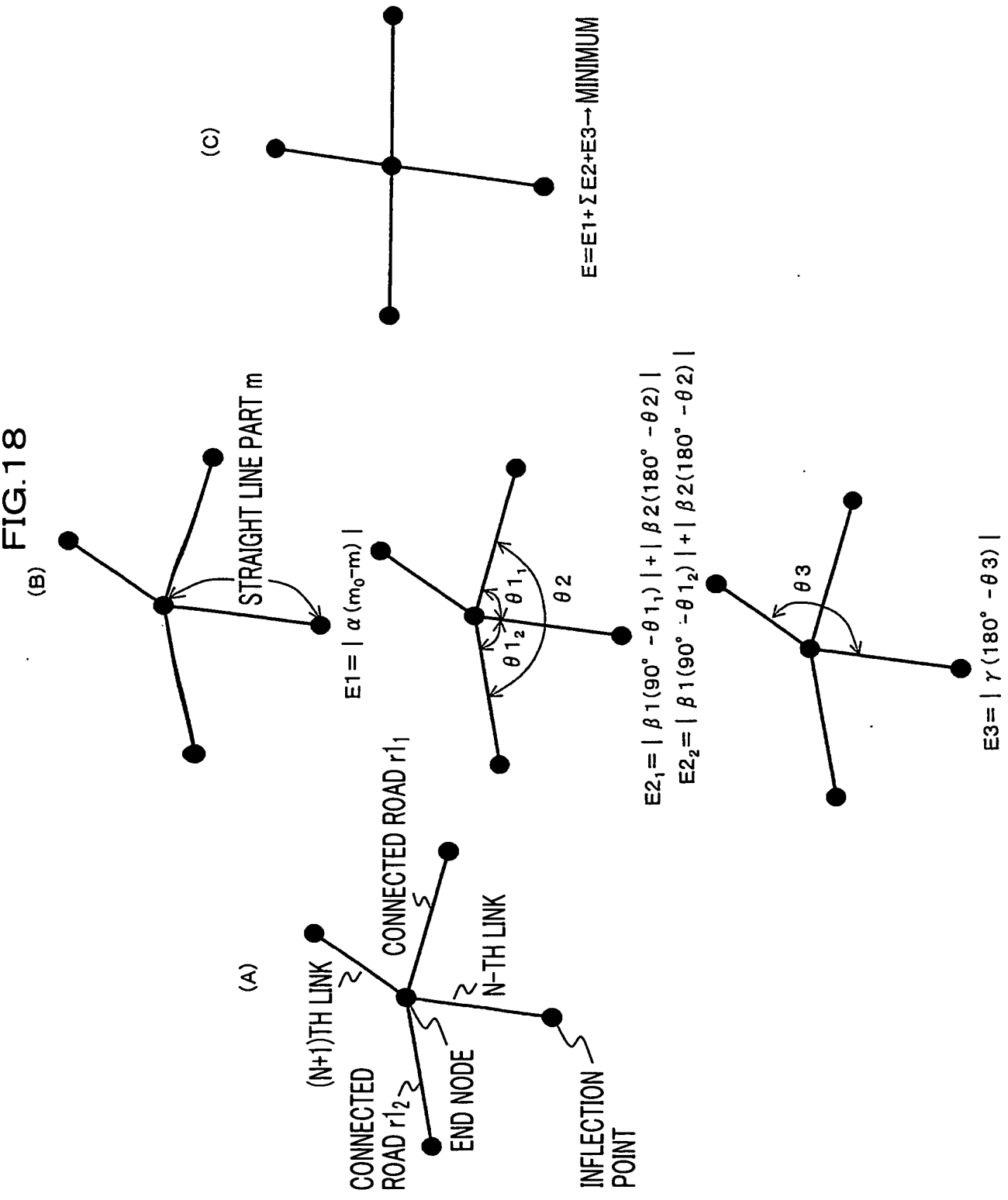

(A)
(N+1)TH LINK
CONNECTED ROAD r1
CONNECTED ROAD r1
END NODE
N-TH LINK
INFLECTION POINT
(B)
STRAIGHT LINE PART m
E1 = | α (m0-m) |
θ1
θ2
E2 = | β1(90° -θ1) | + | β2(180° -θ2) |
E2 = | β1(90° -θ1) | + | β2(180° -θ2) |
θ3
E3 = | γ (180° -θ3) |
(C)
E=E1+ΣE2+E3→ MINIMUM

FIG.19

MAKING-IT-HORIZONTAL AND VERTICAL PROCESS

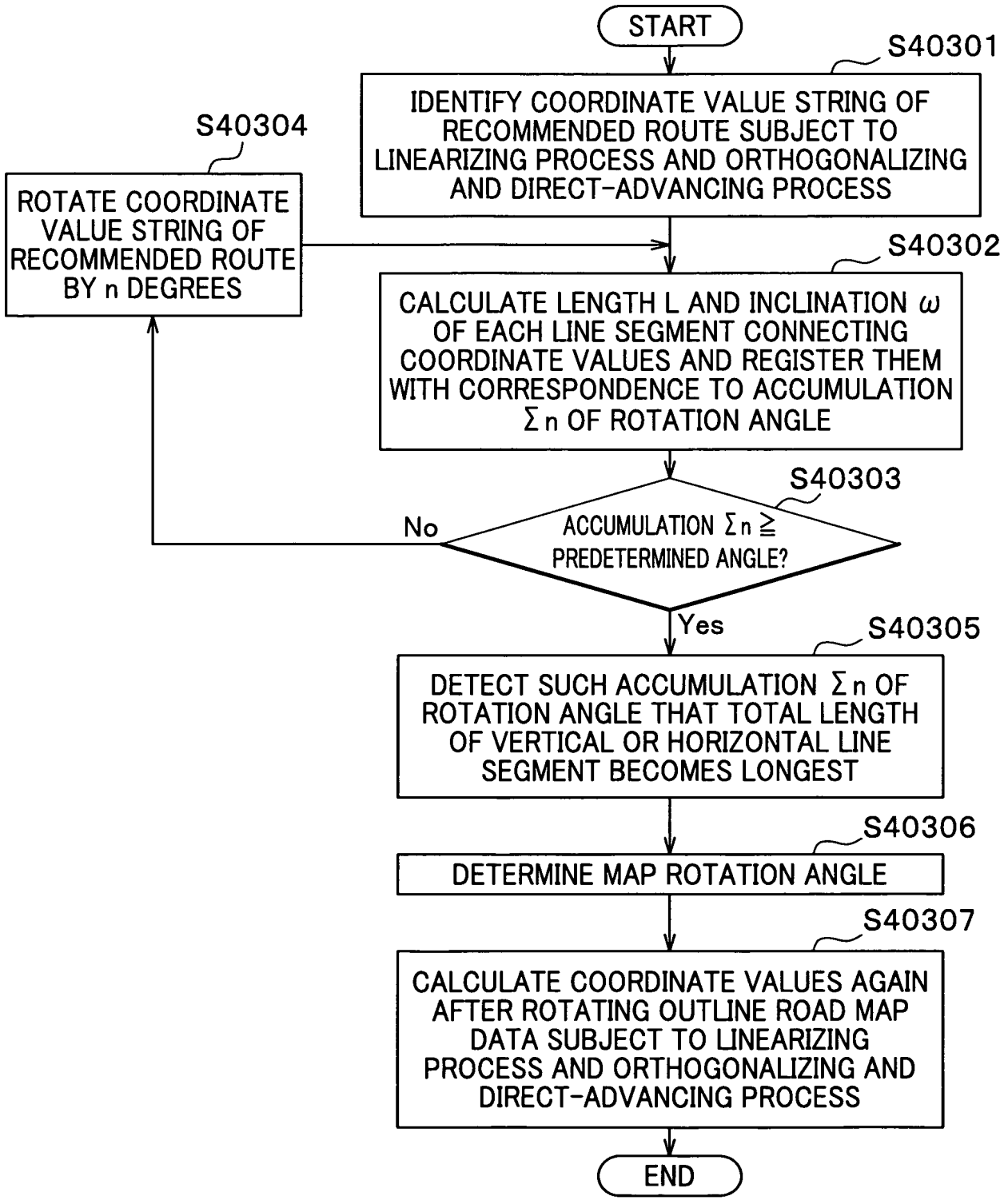


FIG.20

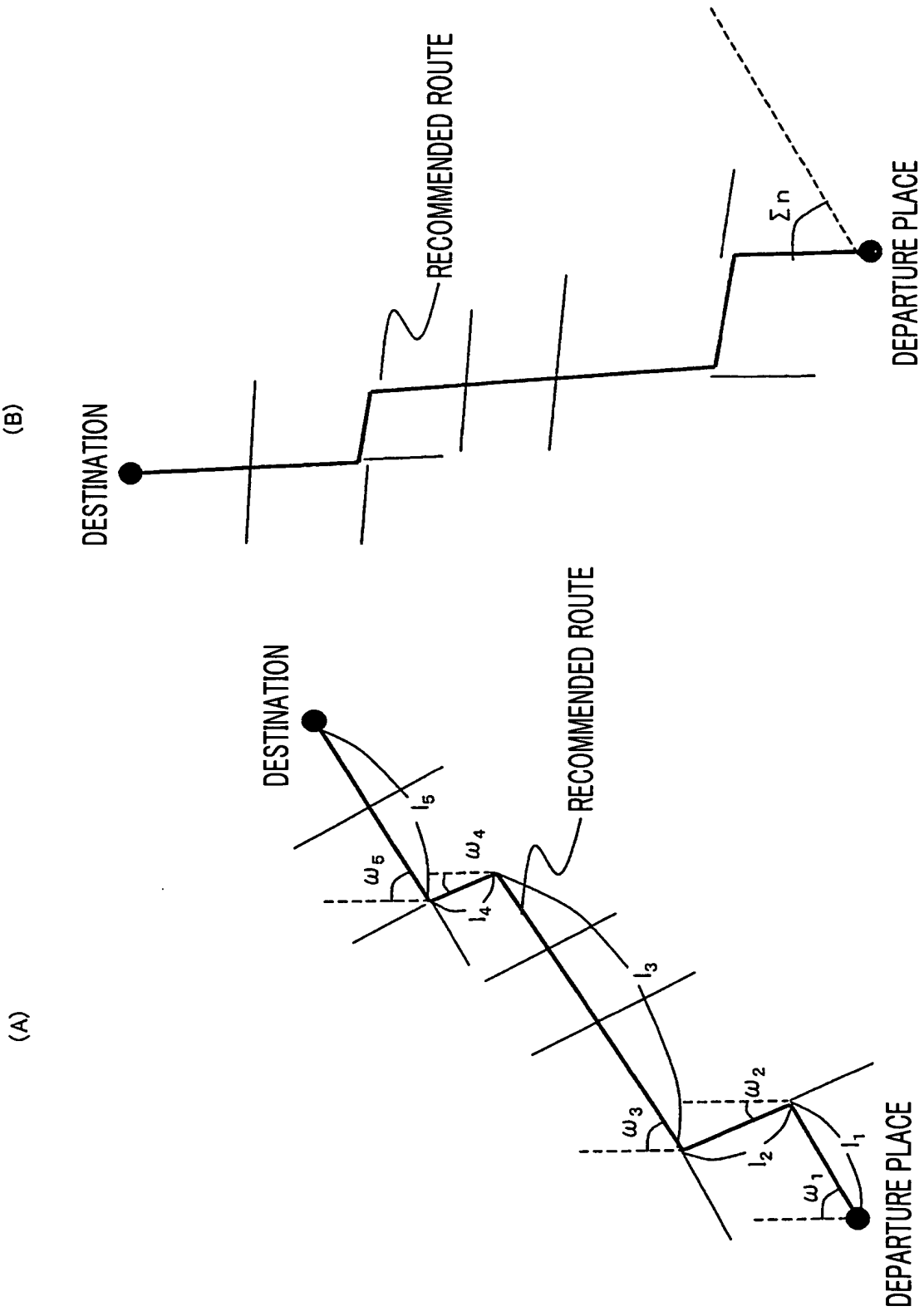

(B)
DESTINATION
RECOMMENDED ROUTE
Σn
DEPARTURE PLACE
(A)
DESTINATION
RECOMMENDED ROUTE
l_5
ω_6
ω_4
l_4
l_3
ω_2
ω_3
l_2
l_1
ω_1
DEPARTURE PLACE

FIG.21

SHAPE-SIMPLIFIED ROAD MAP

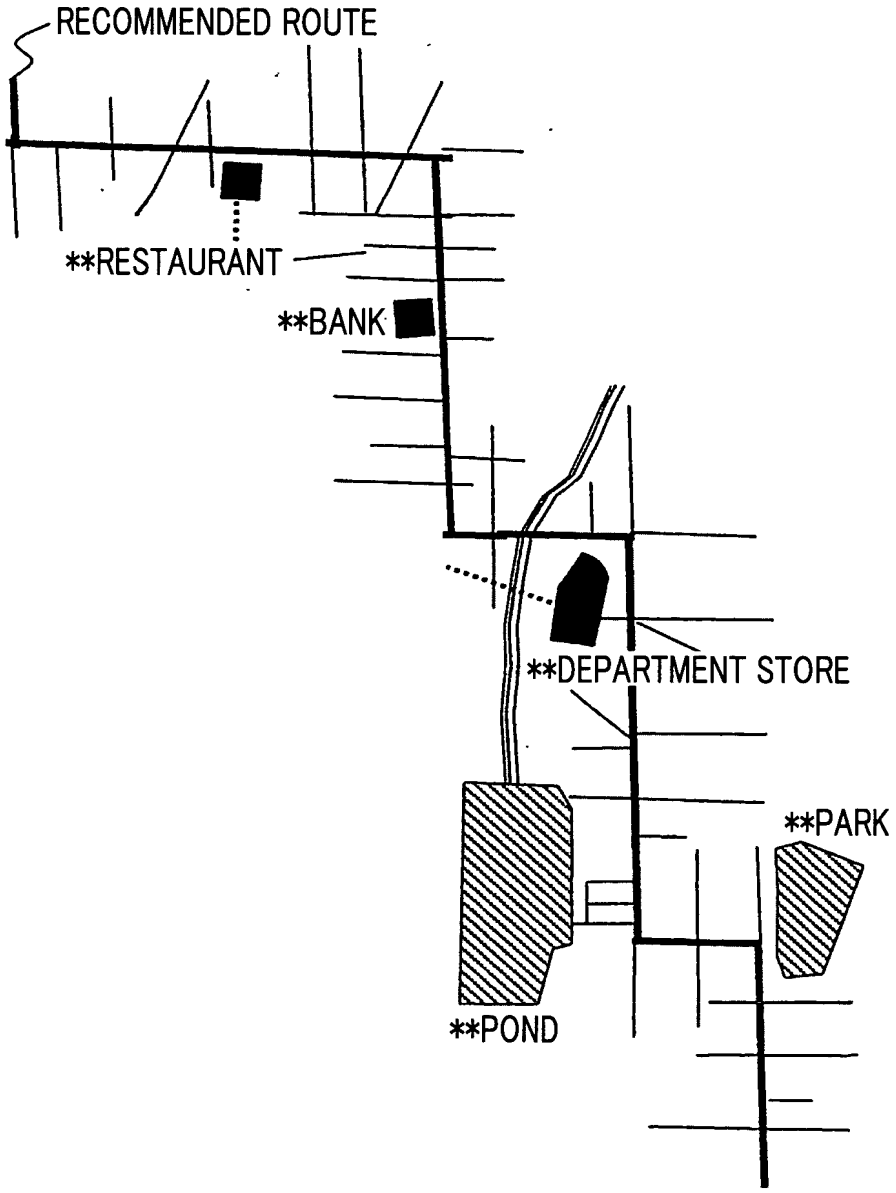


FIG.22

ROUTE GUIDANCE INFORMATION GENERATING PROCESS

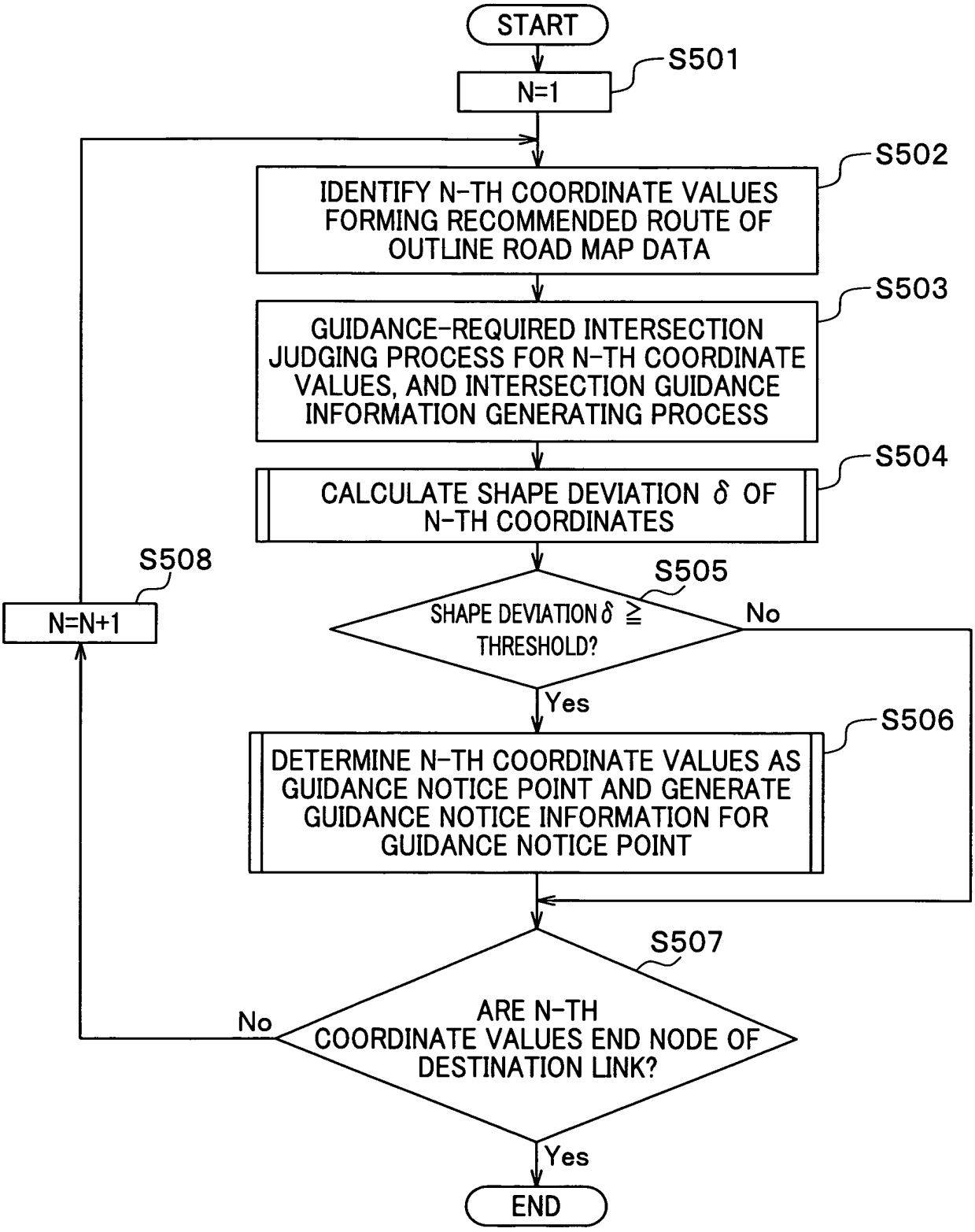


FIG.23

SHAPE DEVIATION CALCULATING PROCESS

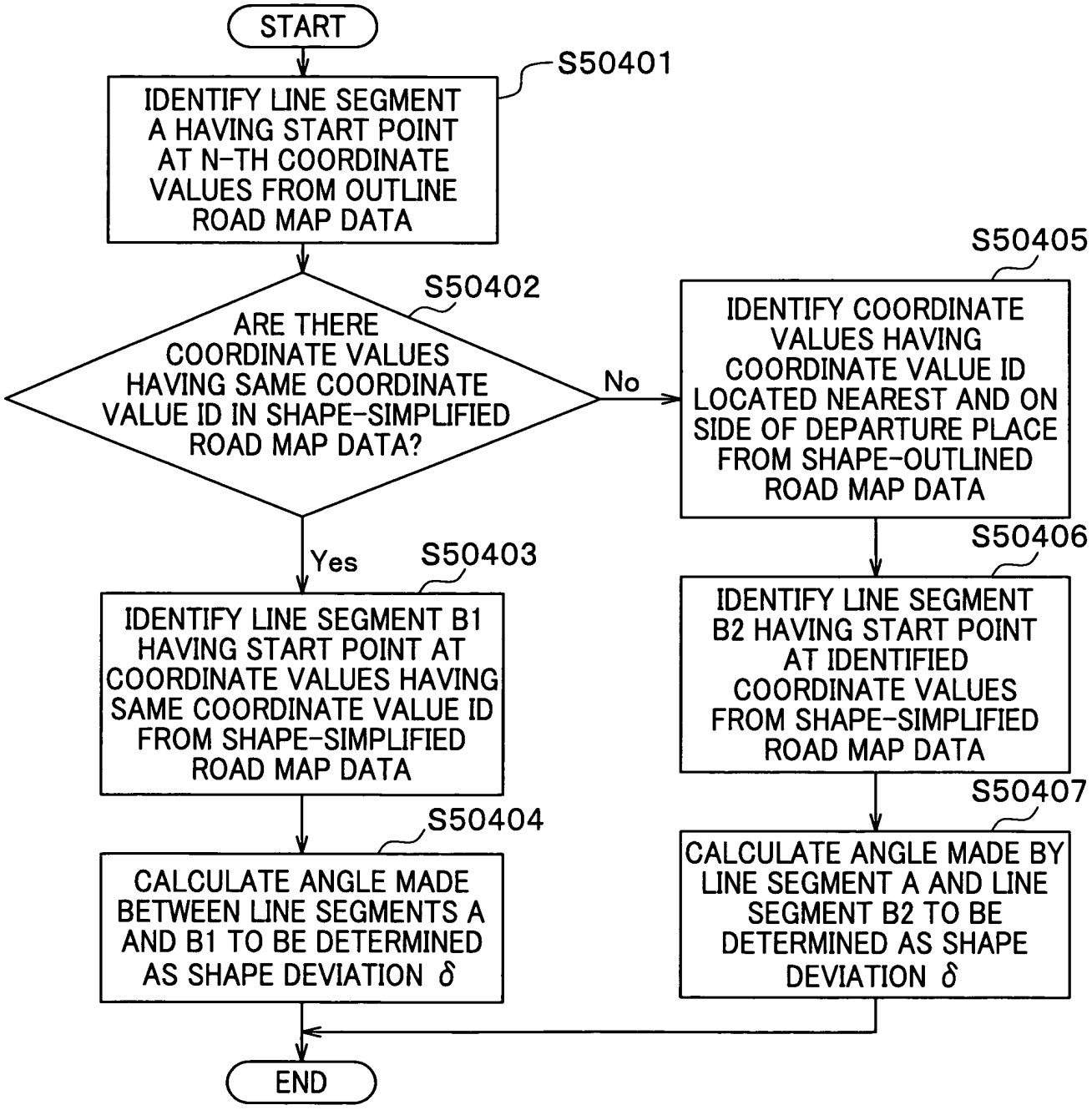


FIG.24

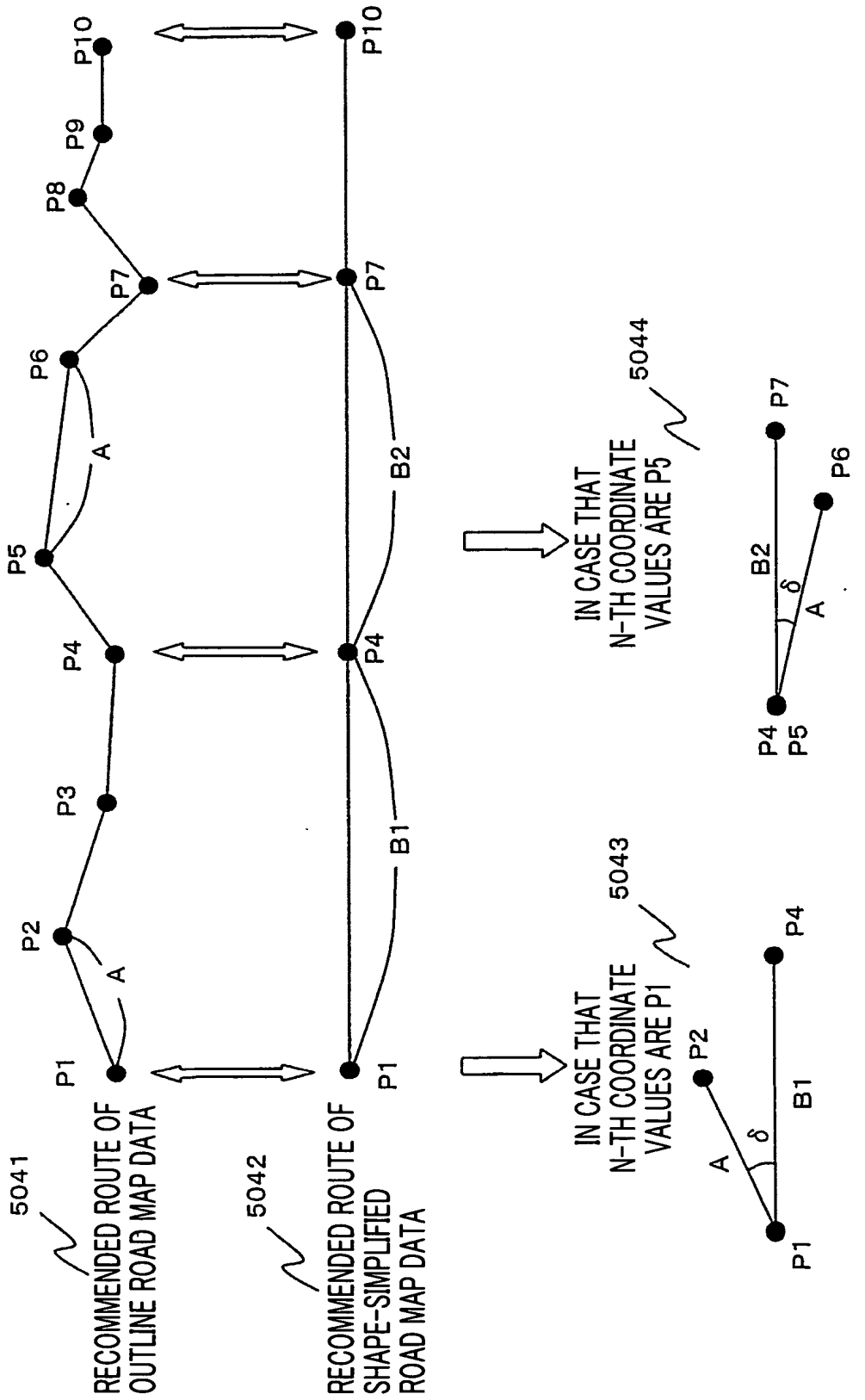

5041
RECOMMENDED ROUTE OF OUTLINE ROAD MAP DATA
5042
RECOMMENDED ROUTE OF SHAPE-SIMPLIFIED ROAD MAP DATA
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
A
B1
B2
IN CASE THAT N-TH COORDINATE VALUES ARE P1
5043
IN CASE THAT N-TH COORDINATE VALUES ARE P5
5044
δ

FIG.25

GUIDANCE NOTICE INFORMATION GENERATING PROCESS

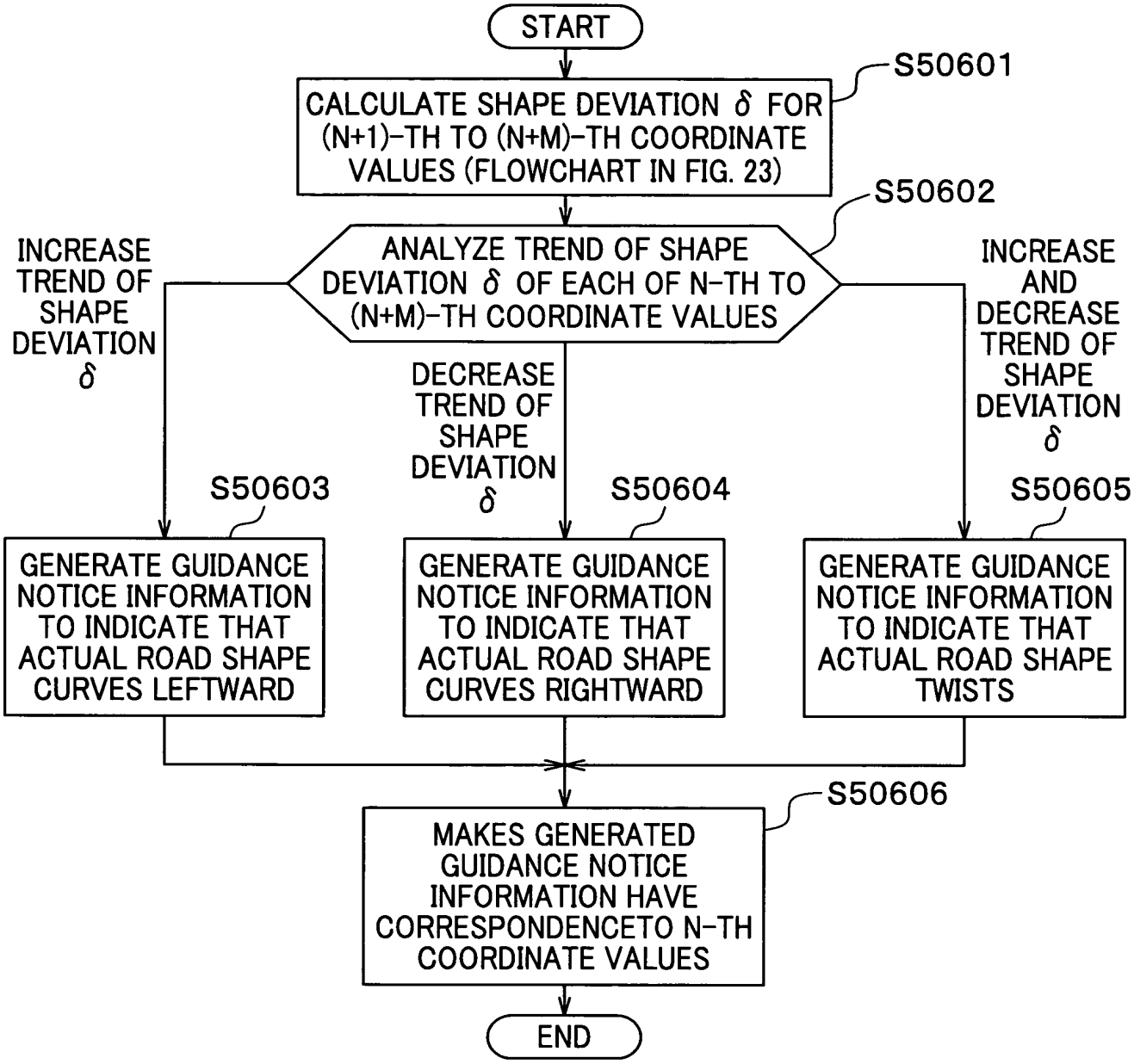


FIG.26

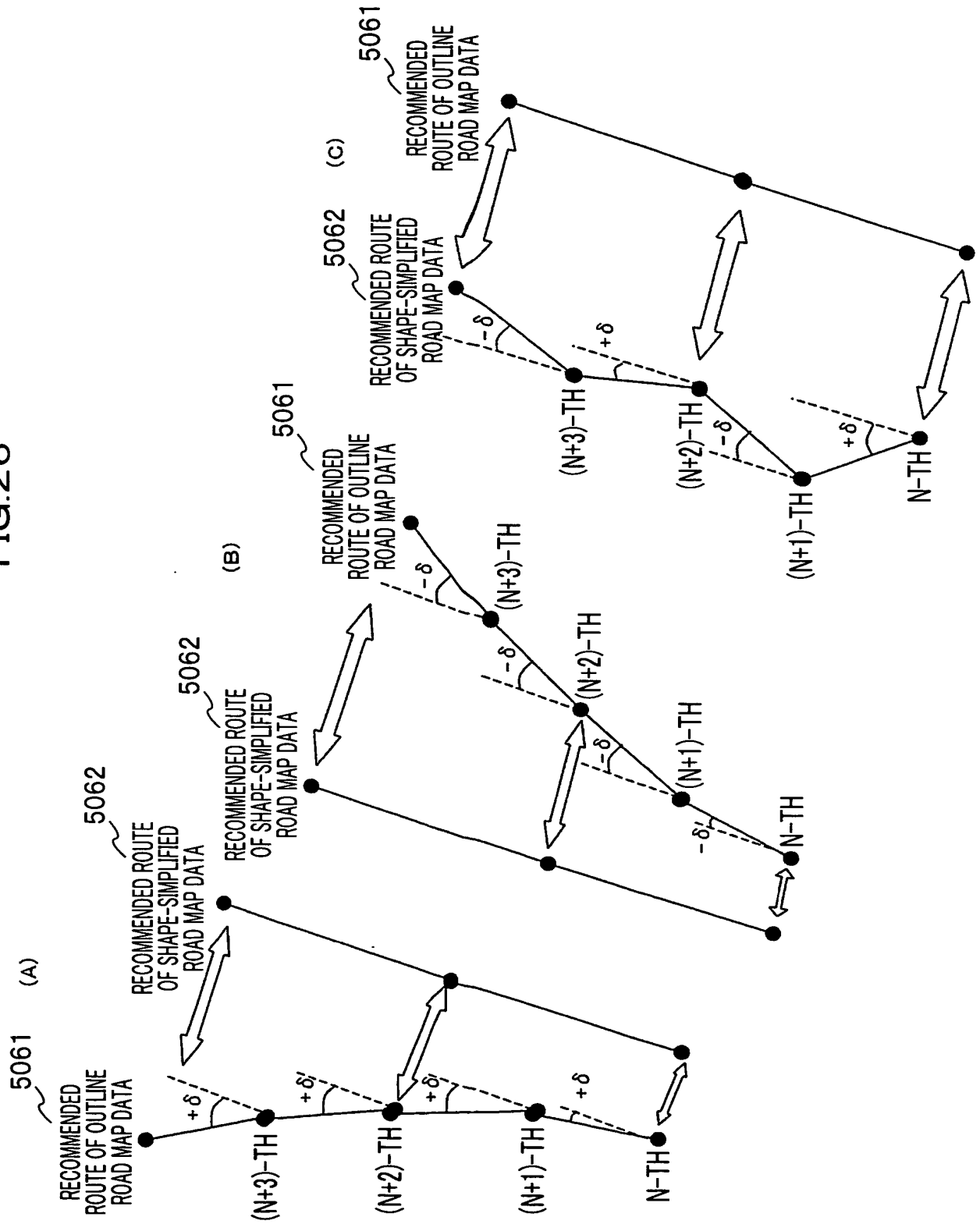

(A)
5061
RECOMMENDED ROUTE OF OUTLINE ROAD MAP DATA
5062
RECOMMENDED ROUTE OF SHAPE-SIMPLIFIED ROAD MAP DATA
+δ
+δ'
(N+3)-TH
(N+2)-TH
(N+1)-TH
N-TH
(B)
5061
RECOMMENDED ROUTE OF OUTLINE ROAD MAP DATA
5062
RECOMMENDED ROUTE OF SHAPE-SIMPLIFIED ROAD MAP DATA
-δ
-δ'
(N+3)-TH
(N+2)-TH
(N+1)-TH
N-TH
(C)
5061
RECOMMENDED ROUTE OF OUTLINE ROAD MAP DATA
5062
RECOMMENDED ROUTE OF SHAPE-SIMPLIFIED ROAD MAP DATA
-δ
+δ
(N+3)-TH
(N+2)-TH
(N+1)-TH
N-TH

FIG.27

GENERAL PROCESS

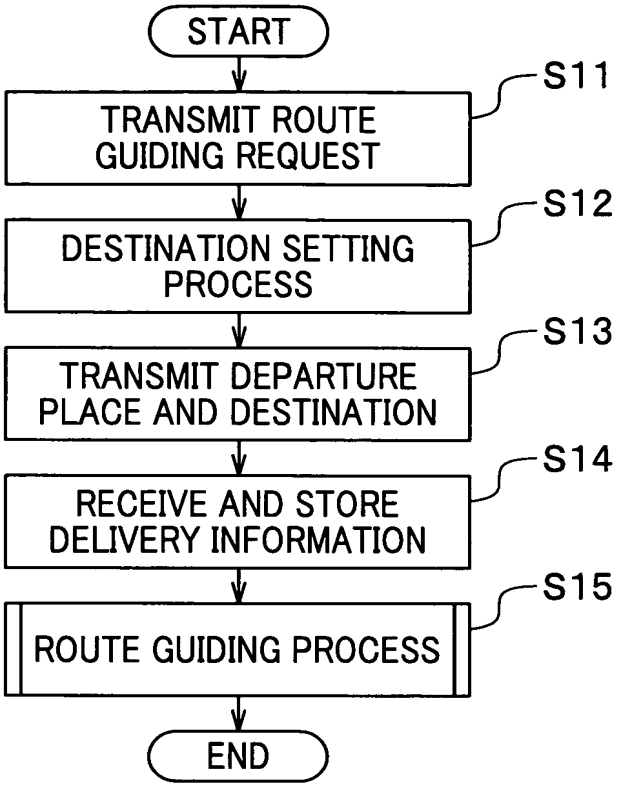


FIG.28

ROUTE GUIDING PROCESS

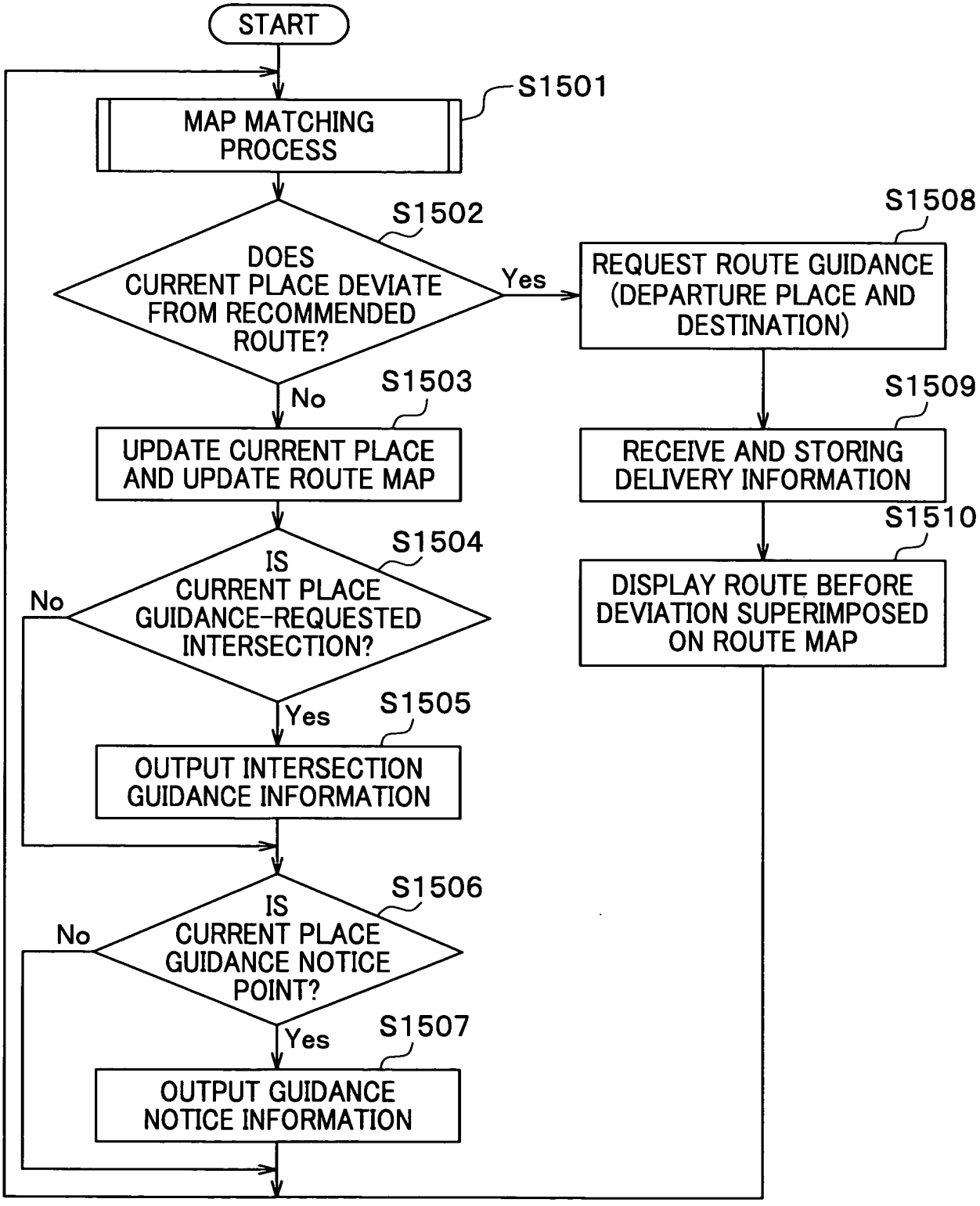


FIG.29

MAP MATCHING PROCESS

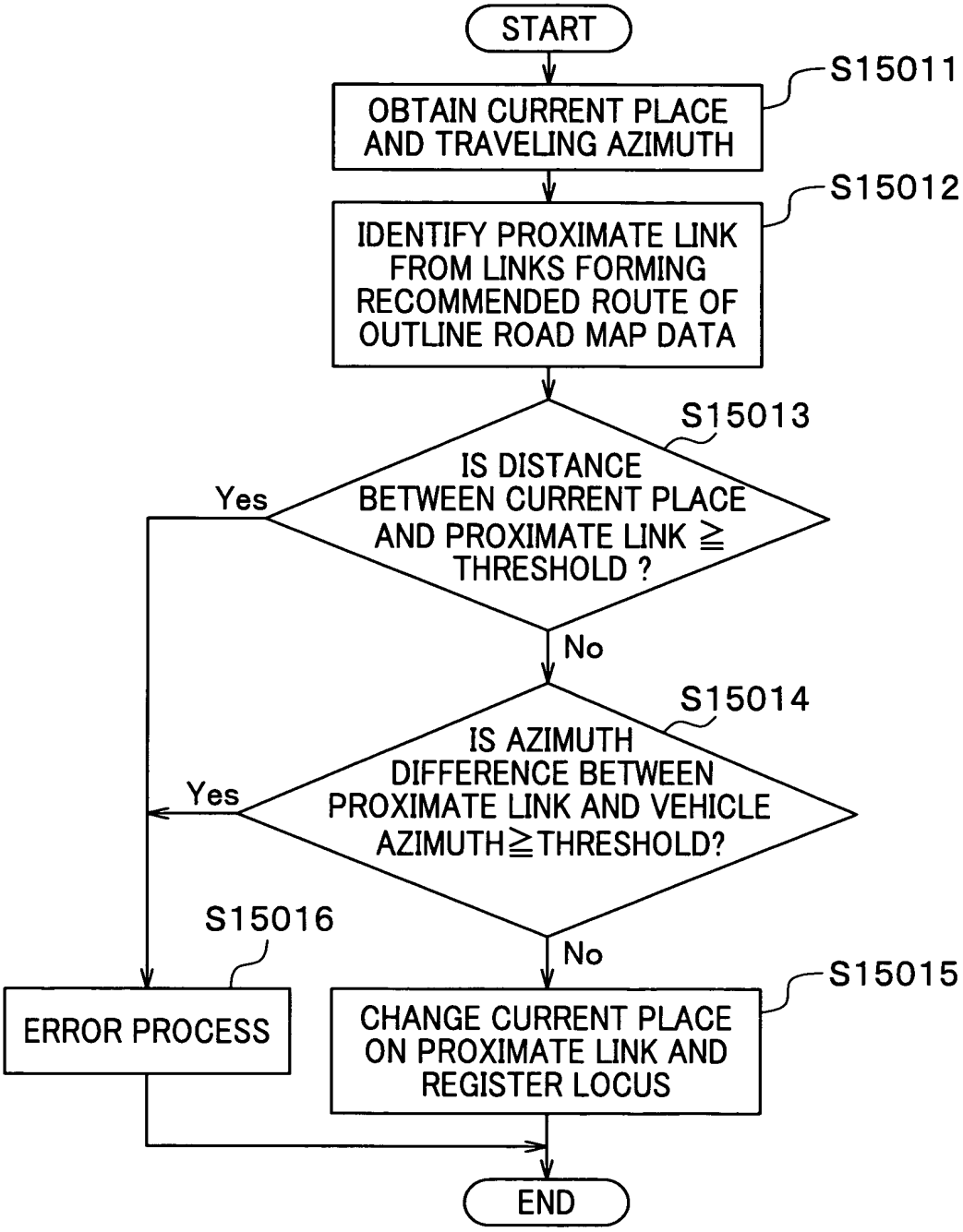


FIG.30

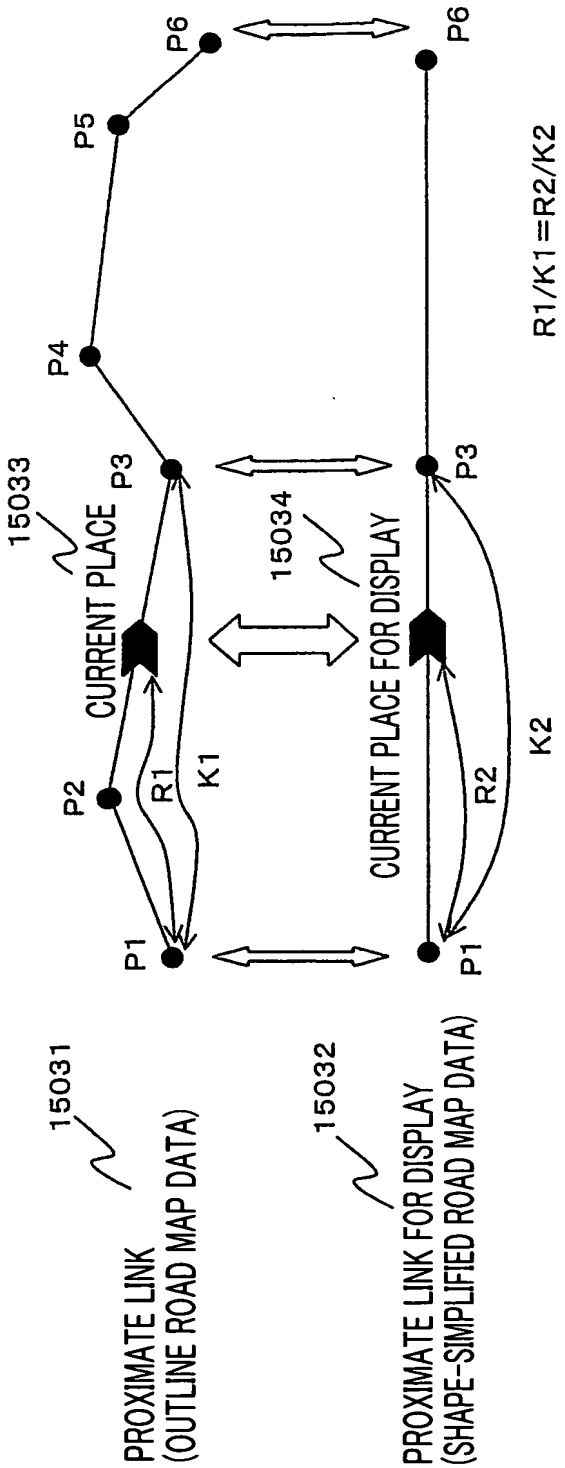

P1
P2
P3
P4
P5
P6
CURRENT PLACE
15033
15034
CURRENT PLACE FOR DISPLAY
R1
K1
R2
K2
R1/K1=R2/K2
15031
PROXIMATE LINK
(OUTLINE ROAD MAP DATA)
15032
PROXIMATE LINK FOR DISPLAY
(SHAPE-SIMPLIFIED ROAD MAP DATA)

FIG.31

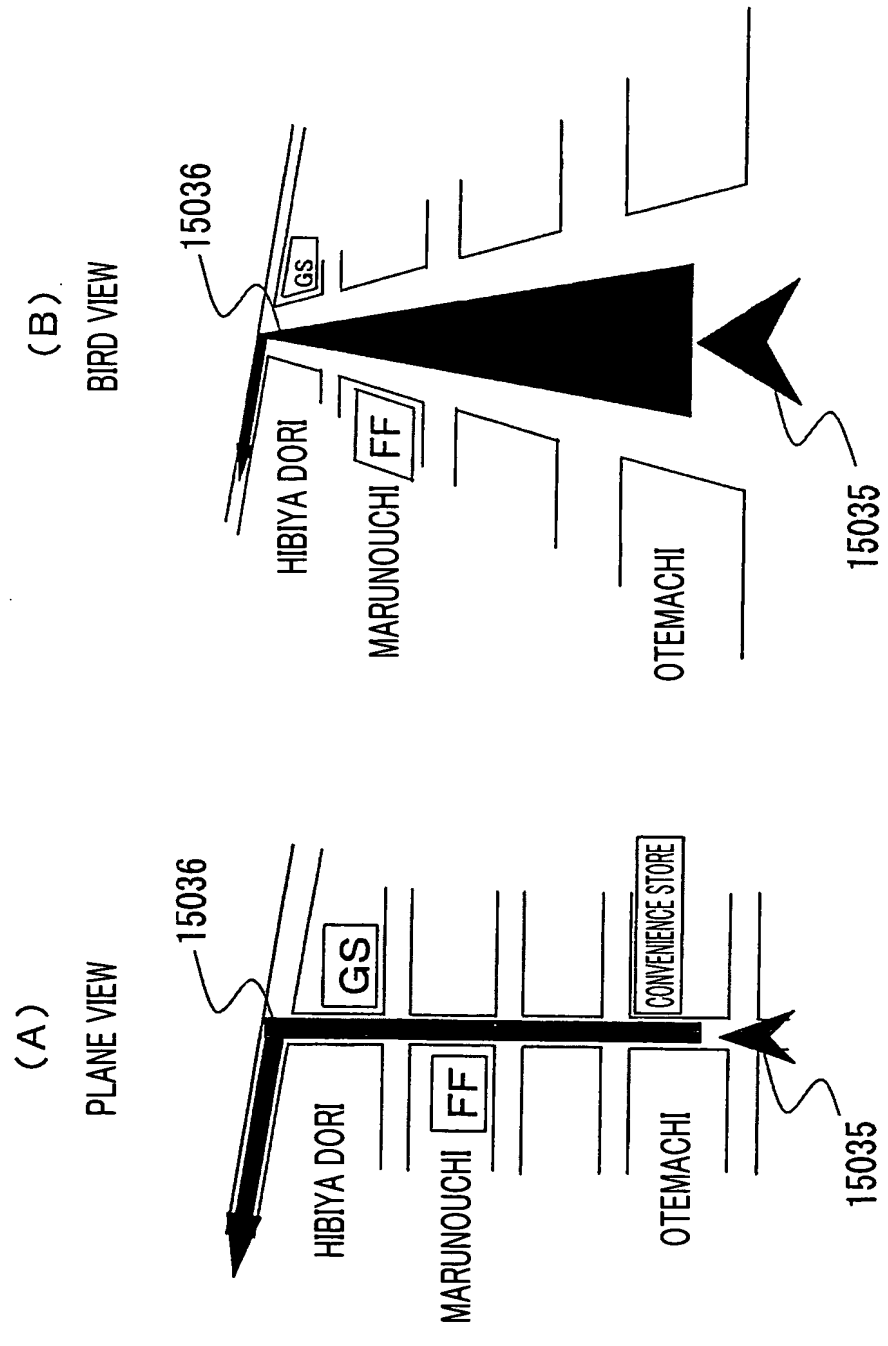

(A)
PLANE VIEW
15036
GS
CONVENIENCE STORE
HIBIYA DORI
FF
MARUNOUCHI
OTEMACHI
15035
(B)
BIRD VIEW
15036
GS
HIBIYA DORI
FF
MARUNOUCHI
OTEMACHI
15035

FIG.32

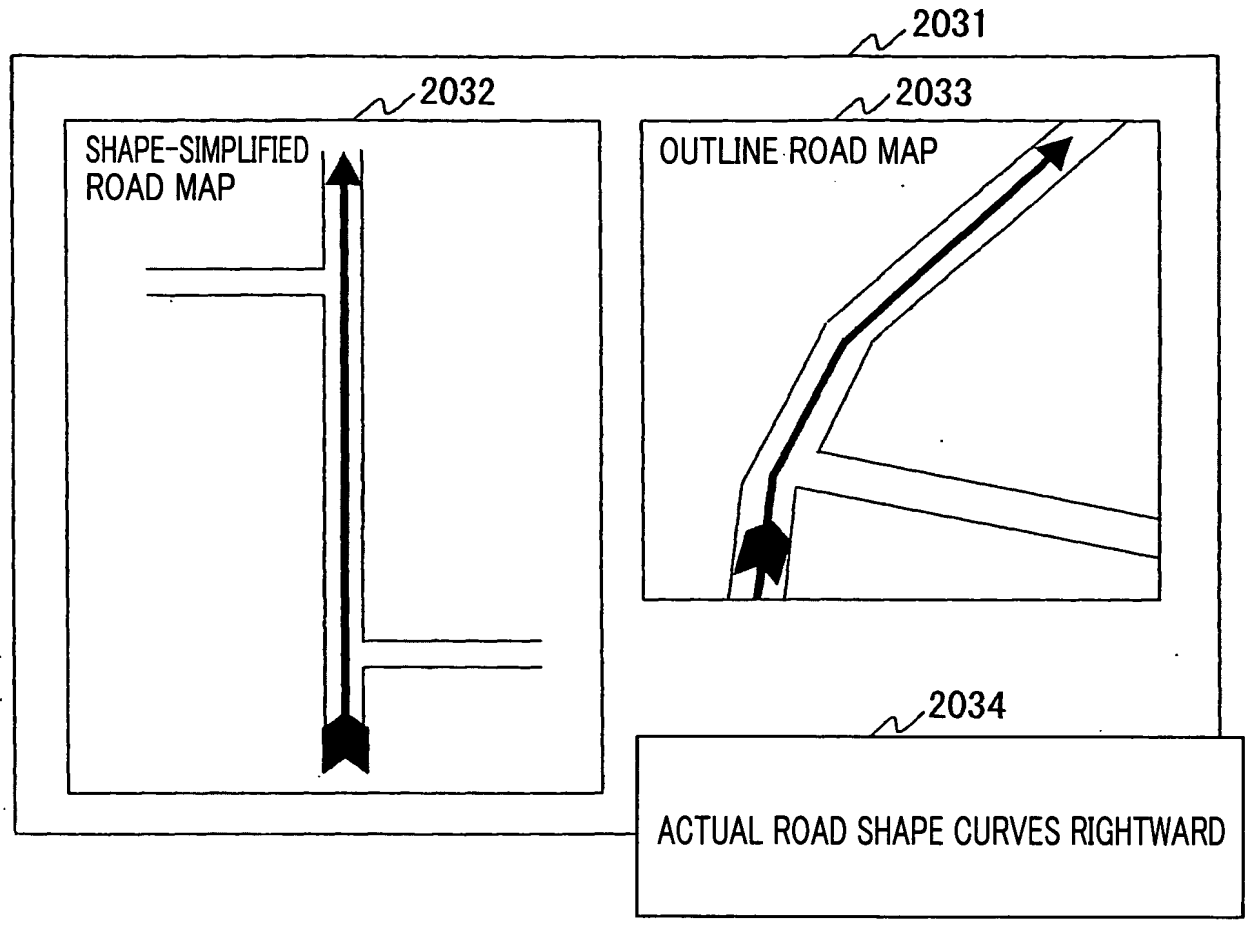
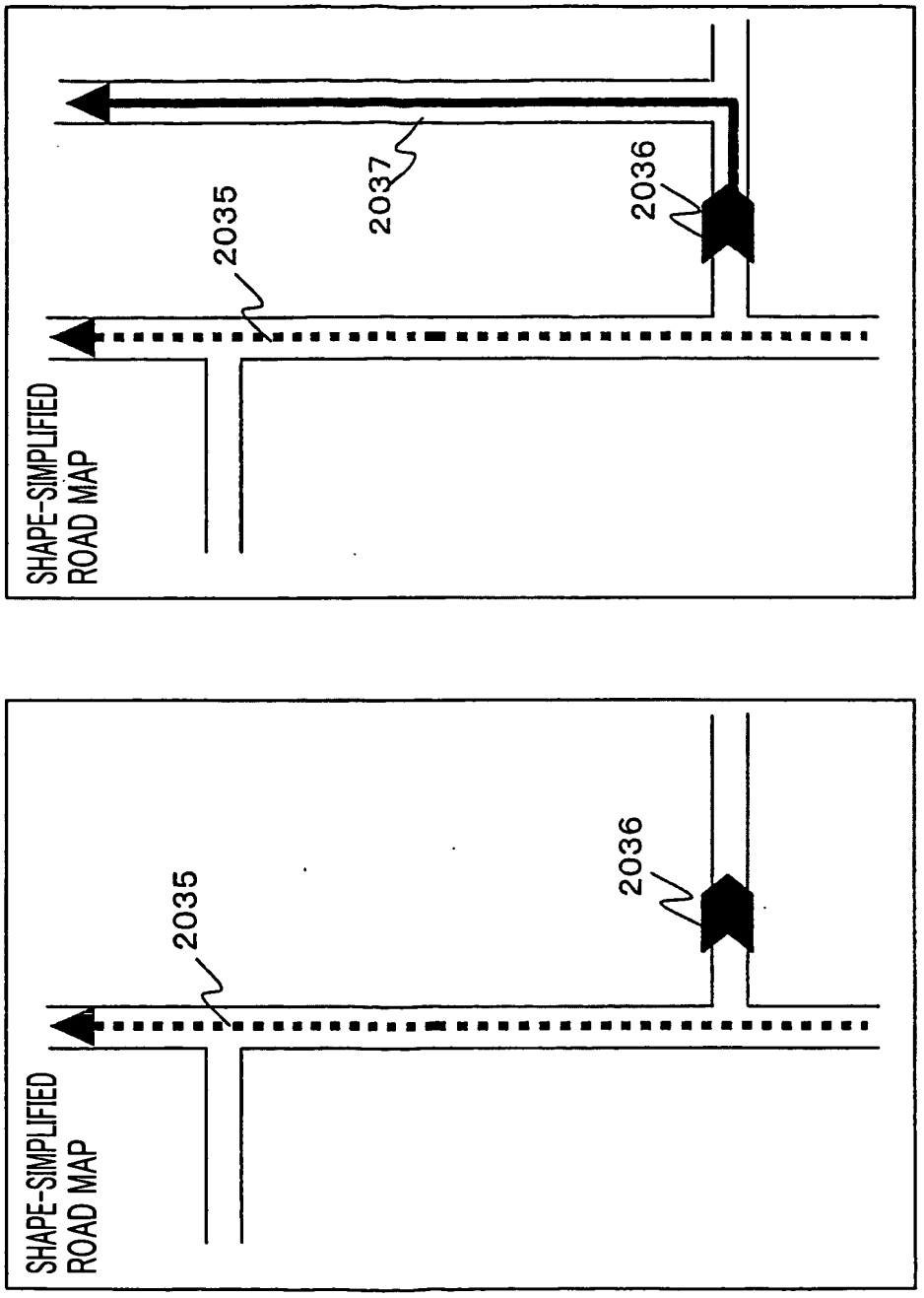

2031
2032
SHAPE-SIMPLIFIED ROAD MAP
2033
OUTLINE ROAD MAP
2034
ACTUAL ROAD SHAPE CURVES RIGHTWARD

FIG.33


(B)
SHAPE-SIMPLIFIED ROAD MAP
2035
2037
2036
(A)
SHAPE-SIMPLIFIED ROAD MAP
2035
2036